A true diaphragmatic hernia is a congenital diaphragmatic malformation that can appear identical to a peritoneopericardial diaphragmatic hernia (PPDH). True diaphragmatic hernias are rare in dogs. Herein we describe the use of positive contrast peritoneography for diagnosis of a true diaphragmatic hernia in two dogs.

Key words: dog, peritoneopericardial diaphragmatic hernia, positive peritoneography, true diaphragmatic hernia.

**Dog 1**

A 2-year-old intact female Pekingese had hypocalcemic neuropathy after parturition. The dog recovered after calcium administration but the owner requested thoracic radiographs for a health inspection. There was an enlarged cardiac silhouette with a focal bulge on its right caudal aspect (Fig. 1). A diaphragmatic hernia was suspected. Positive peritoneography was performed. Nonionic contrast medium, Iohexol was injected into the peritoneal cavity near the midline at a dosage of 1 ml/kg. The pelvis was elevated for about 5 min to facilitate contrast medium flow to the cranial aspect of the abdomen. The contrast medium delineated a round pouch adjacent to the cardiac silhouette. There was no evidence of leakage of contrast medium in either the pericardium or the pleural cavity. A presumptive diagnosis of true diaphragmatic hernia was made and the dog is being monitored without treatment.

**Dog 2**

A 1.5-year-old, female Pomeranian was referred because of a suspected pericardioperitoneal diaphragmatic hernia (PPDH). The right caudal border of the heart was characterized by an abnormal round structure (Fig. 2). A diaphragmatic hernia was suspected. Positive peritoneography was performed as described for Dog 1. A round pouch that protruded into the thoracic cavity identified. There was no communication between the structure and the pericardial sac or the structure and the pleural cavity. A presumptive diagnosis of true diaphragmatic hernia was made and the patient is being monitored without treatment.

**Discussion**

With a diaphragmatic hernia, some abdominal organs enter the thoracic cavity through an abnormal opening. A diaphragmatic hernia may be congenital or acquired, and can be categorized as a PPDH, a pleuropertoneal hernia, or a hiatal hernia. A PPDH is characterized by an incomplete closure of the diaphragm, resulting in prolapse of abdominal viscera into the pericardial sac. A PPDH may be a consequence of faulty development of the dorsolateral septum transversum, or a prenatal injury to the septum transversum. Pleuropertoneal hernias may be traumatic, or as a consequence of failure of the lateral pleuropertoneal folds and the ventromedial pars sternalis to unite. A true diaphragmatic hernia is a congenital diaphragmatic malformation that is distinct from PPDH and also from herniation of abdominal contents into the pleural cavity. With a PPDH, the peritoneal cavity freely communicates with the pericardial sac, but in a true diaphragmatic hernia there is an incomplete diaphragmatic tear in which a direct communication between the pleural and peritoneal...
cavities is prevented by the serosa on the thoracic surface of the diaphragm that remains intact.

A true diaphragmatic hernia is rare in dogs and is usually asymptomatic. A PPDH is also usually asymptomatic but can lead to vague clinical signs. Differentiation between a PPDH and a true diaphragmatic hernia may be achieved with positive contrast peritoneography.

Other conditions may appear similar to a diaphragmatic hernia. A diaphragmatic eventration is a condition where the diaphragmatic muscle is malpositioned. A congenital eventration is a developmental abnormality characterized by muscular aplasia of the diaphragm. Acquired eventration is caused by injury, such as secondary to birth trauma or to an injury sustained during intrathoracic surgery, to the phrenic nerve with resultant paralysis and cranial displacement of the entire diaphragm. Diaphragmatic eventration is rarely symptomatic, and typically only requires conservative treatment or monitoring. In veterinary medicine, diaphragmatic eventration has been referred to as a “true diaphragmatic hernia” and is defined as a subtotal diaphragmatic tear in which the serosa on the thoracic surface of the diaphragm remains intact. A diaphragmatic eventration is characterized by displacement of part of or the whole of the hemidiaphragm cranially without malposition of abdominal organs into the thoracic cavity.

In this report, the abdominal organs did not prolapse into the thoracic cavity, as with the previously reported diaphragmatic eventrations; however, the appearance was different from that expected with a diaphragmatic eventration. The lesion was characterized as a round pouch that contained abdominal viscera and was superimposed over the pericardial sac. In prior reports, the so-called diaphragmatic eventration occurred in the muscular part of the left or right diaphragmatic crura.

A true diaphragmatic hernia may be asymptomatic, as in the dogs in this report, and only monitoring is necessary. However, clinical signs may develop as a previous report in a cat where surgery was considered necessary. A PPDH
can also be asymptomatic; however, various clinical signs, such as respiratory, gastrointestinal, and other vague signs, can develop necessitating surgical correction.\(^8\)

Limitations of our report are that we cannot definitively clarify where the pouch was located, what organs were displaced, or the number and characteristics of the wall layers. However, based on the appearance of the lesions in the peritoneograms, and the difference from prior descriptions of PPDH and diaphragmatic eventration, we speculate that they represented true diaphragmatic hernias.

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**REFERENCES**


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**Fig. 2.** Thoracic radiographs of Dog 2. On the survey lateral view (A), the caudal aspect of the cardiac silhouette (arrows) overlaps with cranial aspect of the diaphragm and on ventrodorsal view (B), a round soft tissue structure (arrowheads) is positioned between the heart and diaphragm (arrows). By positive peritoneography (C, D), the small pouch (arrowheads), delineated by the contrast medium, protrudes from the peritoneal cavity into the pleural space. This line is differentiated from cardiac border (arrow). Contrast medium does not distribute into the pericardial sac, as with a peritoneopericardial diaphragmatic hernia.